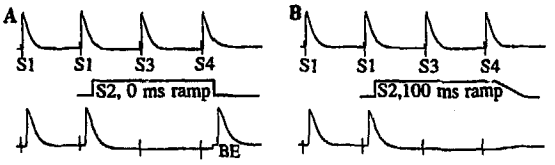
diastolic threshold with a 200 ms S1-S1 interval to mimic tachyarrhythmias, a 400 ms S2 square wave either with or without a decreasing ramp after the square wave was given during the refractory period of the 10th S1-paced AP, followed by S3 and S4 stimuli via the S1 pacing electrode at S1 strength with 200 ms S1-S3 and S3-S4 intervals. Conduction block was determined by the fact that S3- and S4-induced APs were recorded near the S1 site (top of Figs.) but not past the S2 site at the other end of the tissue (bottom of Figs.). Results: The minimum S2 required to block APs was 3.5 ± 1.2 mA. S2 at this strength with no ramp caused break excitation (BE, Fig. A). When the S2 decreasing ramp interval was increased to 225 ± 88 ms, no BE occurred while S3- and S4-induced APs were blocked (Fig. B). Thus, a long, weak ramp stimulus given during the refractory period can block APs and not induce BE.



This finding raises the possibility that if a long weak stimulus terminated by a ramp is applied locally to a reentrant pathway, the pathway may be extinguished without giving rise to a new AP.

1001-103 Distribution of Fast Heart Rate Episodes During Paroxysmal Atrial Fibrillation: Digoxin vs Placebo

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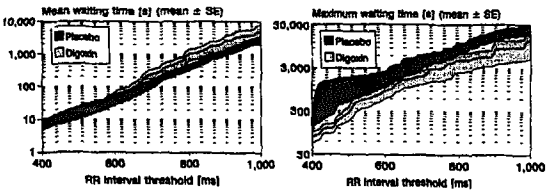
As studies in animals indicate, atrial defibrillators should time shocks to be both QRS-synchronous and delivered following a minimum RR interval, in order to avoid the risk of ventricular proarrhythmia due to stimulation during the ventricular relative refractory period.

This study investigated AF episodes with RR intervals shorter than a given limit (i.e. defibrillator waiting times) in 24-hour Holter tapes recorded during a cross-over trial of Placebo and Digoxin treatment of pts with paroxysmal AF. 25 tapes with AF episodes ≥ 1000 ventricular cycles were selected, 14 of these were recorded on Placebo and 11 on Digoxin. For each tape, the mean and maximum duration of AF episodes with all RR intervals < threshold t were measured ranging t from 400 to 1000 ms in 10 ms steps. The results were averaged for all Placebo and all Digoxin tapes. The Placebo vs. Digoxin values corresponding to different thresholds were compared by a non-parametric U test.



The waiting times increased exponentially with the threshold t (note the logarithmic scale of the graphs). There were no systematic differences between mean waiting times (left) on Placebo and Digoxin, although Digoxin tended to prolong the mean waiting times of t > 700 ms. There were, however, strongly significant differences ($p < 10^{-4} - 10^{-7}$) between between the maximum waiting times which were longer with Placebo (right).

In paroxysmal AF pts, the waiting time required for a "safe" RR interval increases exponentially with the interval selected; technically acceptable delays < 1 minute correspond to thresholds < 600 ms. Maximum waiting times are significantly shortened by Digoxin.

1001-104 Seasonal Variation in Shock Frequency in Patients With Implantable Cardiovertor Defibrillators

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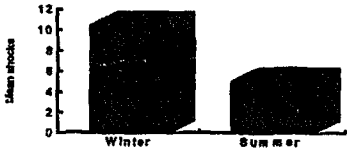
A diurnal variation in implantable cardiovertor defibrillator (ICD) shock frequency is well described, but seasonal variation remains unexplored.

Aim: This study examines the seasonal variation in appropriate ICD shock frequency.

Patients and Methods: All patients who had ICD's implanted at our institution over the last 6 years had documentation of date of delivery of shock therapy. The frequency of shock delivery during the summer months (April to September) was compared to that during winter months (October to March).

Results: 86 patients with ICD's (mean age 45 ± 14 years) were followed for a mean of 2.5 ± 1.7 years. 45 patients received 321 appropriate shocks during this period. In patients receiving shocks, there was a mean total of 10.3 shocks during winter months in comparison to 4.9 shocks over summer months ($p < 0.03$). A marked seasonality of shock frequency was observed.



Conclusions: Seasonality of the occurrence of malignant ventricular arrhythmia appears to exist, with a higher frequency in winter months. Factors which may influence occurrence of malignant ventricular arrhythmia over the colder winter months remain unexplored.

1001-105 Is the Pectoral Implantation Site of the "Active Can" Cardioverter/Defibrillator Device of Importance for the Defibrillation Threshold

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The active can unipolar cardioverter defibrillator (ICD) has been shown to defibrillate efficiently, but the ideal position of the left pectorally implanted defibrillator device (Can) is unknown. We examined the differences in biphasic shock defibrillation thresholds (DFT) achieved at defibrillator implant using four different left pectorally implantation sites: high pectoral medial position (A), high pectoral lateral position (B), low pectoral medial position (C) and low pectoral lateral position (D). DFTs at implant were tested using a step down protocol. The study population comprised of 60 patients (mean age 60 ± 11 years; 51 m/9 f). The presenting rhythm was VF in 29 and VT in 31 patients. Underlying ischemic heart disease was present in 39, idiopathic cardiomyopathy in 17, and valvular heart disease in 4 patients. (LVEF 39 ± 14%).

Results: No differences were observed between these groups regarding age, gender, organic heart disease, LVEF, and antiarrhythmic drugs during DFT-testing.

	Position A	Position B	Position C	Position D
No. of pts	12	18	15	15
DFT (J)	11.6 ± 3.3	12.5 ± 3.7	7.5 ± 2.3*	16.9 ± 5.1*

*$p < 0.05$

Conclusion: 1. Low defibrillation thresholds with pectorally implanted ICD are achieved regardless of the implantation site of the active can. 2. The best position seemed to be the low pectoral medial region. 3. The DFT was about 50–100% higher in the 3 other pectoral positions.

1001-106 Inappropriate Sensing of Atrial Stimuli in Patients With a Third Generation Defibrillator and DDD Pacemaker

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Although the problem of ICD sensing of paced ventricular stimuli has been resolved by incorporation of VVI pacing into current ICDs, many pts require separate DDD pacemakers (PMs) for maintenance of AV synchrony. We report a problematic PM-ICD interaction: inability to prevent sensing of paced atrial stimuli (a-sensing) leading to double-counting in PM-requiring pts with transvenous (TV) ICDs with [illegible] autogain sensing (Ventak PRx2 or 3). In 7 pts (6 M, 1 F; mean age 72, mean EF 29%; 6 CAD, 1 CM), a TV DDD PM was implanted following (6) or concomitantly with (1) a TV ICD. Indications for pacing: heart block (HB) (6 pts), sinus brady (1).

Results: All 7 pts had CPI Endotak leads at the RV apex. 4/7 pts had a-sensing, leading to double counting, despite intra-operative testing of multiple atrial locations with an active-fixation lead. No pt had sensing of ventricular stimuli, with all PM leads positioned on the RV septum. 6 pts had a PRx2/3 ICD, 4 with a-sensing (66%), and 1 a PRx, without a-sensing. Pts with a-sensing were not distinguished by measured R or P waves, atrial threshold, type of atrial lead, or RA size. In all pts with a-sensing, (all HB) double-counting was avoided by programming the PM to VDD mode. No pt has received inappropriate therapy or failed to sense VF in follow-up.